

## DIAGNOSTIC METHOD FOR MONITORING A PLUG-IN CONNECTION

The present invention relates to a diagnostic method for monitoring at least one plug-in connection to an antenna, in particular a plug-in connection in the antenna signal path to a window-integrated antenna of a vehicle.

## 5 Background Information

It is known to establish a current window for a normal operating range of an active circuit in the antenna signal path of receivers, e.g. radio or TV receivers, for diagnosing plug-in connectors or plug-in connections. An error is  
10 signaled when the power consumption is outside the predefined current window.

## Advantages of the Invention

Using the measures of Claim 1, i.e., the following steps:

- a diagnosis signal is supplied via the antenna signal  
15 path toward the antenna,
- the diagnosis signal bypasses an active circuit provided in the antenna signal path;
- the power supply of the active circuit is influenced depending on whether the diagnostic signal experiences an  
20 error due to at least one plug-in connection,
- it is detected whether the power consumption of the active circuit is outside a predefined window and, in such a case, an error is signaled; in contrast to conventional approaches, several plug-in connections can be diagnosed, in  
25 particular the plug-in connection/plug-in connector to the

window-integrated antenna of a car. In conventional approaches, only one diagnosis is performed for the plug-in connector from the receiver to the impedance transformer, i.e., to the active antenna adapter circuit. The plug-in connection to the window-integrated antenna is not diagnosed or is only diagnosed via a loop having two separate contacts.

A missing windshield contact is easily diagnosed in complex diversity systems using the method according to the present invention. The present invention offers the option of monitoring all plug-in connections in different antenna structures, even those of an optionally provided diversity device.

The method according to the present invention is characterized in that the diagnostic signal(s) is/are supplied to the antenna at the RF antenna terminal of the receiver, i.e., into the RF cable to the antenna. No additional plug-in contacts are therefore needed.

In rear window-integrated antennas, one side of the heating field is always grounded, so that detection is possible via only one plug-in contact.

In separate antenna structures, detection may take place via a bridge in the windshield connector.

#### Drawing

Exemplary embodiments of the present invention are elucidated in greater detail below on the basis of the drawing.

The figures show:

Figure 1 a first exemplary embodiment having an antenna structure grounded on one side;

Figure 2 an alternative exemplary embodiment of a generic antenna structure;

Figure 3 feedback of the diagnostic signal to the power supply  
of an active circuit;

Figure 4 joint monitoring of a diversity device;

Figure 5 an alternative embodiment for joint monitoring of a  
5 diversity device;

Figure 6 an alternative to the joint monitoring of a diversity  
device and analysis via a diagnostic resistor;

Figure 7 additional alternatives to the joint monitoring of a  
diversity device;

## 10 Detailed Description of the Exemplary Embodiments

Figure 1 shows a rear window 1 of a vehicle, its heating wires  
for windshield defrosting being used as an antenna. An antenna  
adapter 3, i.e., an impedance transformer, which is designed  
in this case as an active amplifier circuit 31, is located in  
15 the antenna signal path between antenna and receiver 2, in  
particular a car radio and/or a TV set. The DC supply signal  
for active circuit 3 is used simultaneously as a diagnostic  
signal for plug-in connections 4 in the antenna signal path.  
The signal travels via RF cable 5 to impedance transformer 3,  
20 where it is split off via inductors 6 into the transverse  
branch and via capacitors 7 into the longitudinal branch,  
bypassing active circuit 31. At the windshield-side terminal  
end of active circuit 31, it is added to the RF antenna signal  
again. In the embodiment of Figure 1, the diagnostic signal is  
25 conducted in the secondary path of active circuit 31 via a  
diagnostic resistor 8, which has a high resistance in  
particular of 10 kOhm, for example.

The diagnosis of the correct or existing plug-in contact is  
detected both as a result of a voltage drop across a  
30 diagnostic resistor 8, resulting in a constant current flow,  
and as a result of an interruption in the power supply. The  
diagnostic method and the diagnostic device according to the

present invention are characterized in that the diagnostic signals are supplied to the RF antenna terminal so that no additional plug-in contacts are needed.

5 If a connection is unplugged or the plug-in contact is not error-free, a circuit breaker 10 for active circuit 31 is activated by analyzer unit 9 connected to diagnostic resistor 8, via the voltage drop across high-resistance diagnostic resistor 8. No current or a very weak current flows due to this shut-off of active circuit 31. This is detected in  
10 receiver 2, i.e., the power consumption of active circuit 31 is outside a predefined window and an error is signaled in receiver 2. In the rear window-integrated antenna illustrated in Figure 1, one side of the heating field is grounded, so that detection is possible here via only one windshield-side  
15 plug-in contact. In the case of separate antenna structures according to the exemplary embodiment illustrated in Figure 2, detection may take place via a bridge 42 to ground in windshield connector 4. The monitored plug-in connections are identified by a solid dark rectangle in all figures.

20 In the exemplary embodiment according to Figure 3, diagnostic resistor 8 in the secondary path of active circuit 31 is unnecessary because the diagnostic signal is fed back to power supply terminal 32 of active circuit 31 after passing through the windshield-side plug-in connector via bridge 43.

25 In the exemplary embodiment according to Figure 4, the plug-in connections of diversity device 21 connected upstream from adapter stage 3 are also monitored. Also in this case, the diagnostic signal is phantom-supplied via RF cable 5 of the antenna signal path, is split off at the input of diversity  
30 device 21, bypasses the active circuit of diversity device 21, and is added again to the RF signal at the output.

Figure 5 shows a diversity device 21 having an integrated (downstream) adapter stage. The diagnostic signal is split off

at the input of diversity device 21, bypasses the active circuit(s) of the diversity device and adapter stage 3 to the windshield-side output of the adapter stage, and is added again to the RF signal.

5 Figure 6 shows an alternative to Figure 5 having an integrated diversity device. In this case, as in Figure 1, diagnostic resistor 8 having analyzer unit 9 and power supply interrupter 10 is provided as an alternative to the feedback of the diagnostic signal via a bridge at the windshield-side plug-in connector.

Figure 7 shows the diagnostic signal bypassing the active circuit of the upstream diversity device and the analysis of the voltage drop across diagnostic resistor 8 in adapter circuit 3 provided as in Figure 1.